REMARKS

The present response is intended to be fully responsive to all points of rejection raised by the Examiner and is believed to place the application in condition for allowance. Favorable reconsideration and allowance of the application is respectfully requested.

Claims 6, 10, 16, 20, 26, 30-54 are pending in this case. Claims 6, 10, 16, 20, 26, 30-33, 35-37, 39-54 have been rejected under the judicially created doctrine of obviousness-type double patenting. Claims 6, 10, 16, 20, 26, 30-33, 35-37, 39-54 have been rejected under 35 U.S.C. § 102(e). Claim 38 has been allowed. Independent claims 6, 16, 26, 43 have been amended.

With respect to the Examiner's 35 U.S.C. § 102(e) rejections, Applicant has reviewed the cited art and respectfully submits that the art fails to disclose or suggest the Applicant's claimed invention. Therefore, Applicant respectfully traverses and requests favorable reconsideration.

Personal Interview

Applicant wishes to thank the Examiner for granting a personal interview on August 7, 2007. The interview participants included Primary Examiner Duy M. Dang and Howard Zaretsky (Applicant's representative).

Response to Double Patenting Rejection

The Examiner rejected claims 6, 10, 16, 20, 26, 30-33, 35-37, 39-54 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-42 of U.S. Patent No. 6,314,452 (referred to as the '452 patent hereinafter). The Examiner indicated that although the claims are not identical, they are not patently distinct from each other.

It is submitted that the '452 patent teaches a system and method of transmitting two dimensional (2D) images over a communications network whereas the present invention as taught and claimed is a system and method for streaming three dimensional (3D) images. The specification of the present invention contains detailed descriptions of the mechanism of performing a 3D wavelet transform on a 3D source image and of the mechanism of transmitting the coefficients that are the result of the 3D wavelet transform from the server computer to the client computer. The disclosure related to the 3D wavelet transform processing and streaming found in the present application is not found in the '452 patent.

A key difference between the mechanisms of the present invention and that of the '452 patent is that the 3D wavelet transforms taught in the present invention generate an **interslice or inter-image correlation** in the resulting 3D subband coefficient data. In other words, the three dimensional subband coefficient data embodies or includes correlations between the slices of a three dimensional image or between the images of a sequence of images. This limitation has been added to each of independent claims 6, 16, 26, 43. Note that the three dimensional image as contemplated by the present invention may comprise a sequence of 2D images. The 2D wavelet transforms of the '452 are not capable of generating any interslice correlation information as they are strictly 2D wavelet transforms. Thus, if they were applied to a sequence of 2D images, the result is simply a sequence of 2D transforms with **no inter-image correlation information** whatsoever.

In contrast, the 3D wavelet transform of the present invention **does** generate correlation information between slices of a 3D image or between the 2D images of a sequence of images.

For this reason it is submitted that the 3D oriented claims of the present application are patently distinct from the 2D only oriented claims of the '452 patent.

Applicant therefore believes that claims 6, 10, 16, 20, 26, 30-33, 35-37, 39-54 overcome the Examiner's rejection based on obviousness-type double patenting grounds. The Examiner is respectfully requested to withdraw the obviousness-type double patenting rejection.

Response to 35 U.S.C. § 102(e) Rejections

The Examiner rejected claims 6, 10, 16, 20, 26, 30-33, 35-37, 39-54 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,711,297 ("Chang et al."). Applicant respectfully submits that the prior art fails to disclose or suggest at least a server computer operative to apply a **three dimensional** wavelet transform to an image sequence to generate interslice correlation information and to progressively transmit **three dimensional** subband coefficient data blocks to a client computer. Therefore, Applicant respectfully traverses the rejections and request favorable reconsideration.

Applicant has reviewed the cited art and respectfully submits that the art fails to disclose or suggest the Applicant's claimed invention, and fails to teach each and every element and limitation of the claims rejected herein. Therefore Applicant respectfully traverses the rejections and requests favorable reconsideration.

While continuing to traverse the Examiner's rejections, Applicant, in order to expedite the prosecution, has chosen to clarify and emphasize the crucial distinctions between the present invention and the devices of the patents cited by the Examiner. Specifically, representative claim 6 has been amended to include a system for transmitting **three dimensional (x, y, z axis) digital source images** over a communication network, comprising a storage device for storing three dimensional digital source images, a client computer coupled to the communication network, said client computer operative to generate and transmit to a server computer a request for interaction with the three dimensional source image stored on said image storage device, said request for interaction comprising an ordered request list specifying data blocks for progressive rendering of a given region of interest (ROI) within said three dimensional source image, and said server computer coupled to the communication network and said image storage device, the server computer comprising means for preprocessing said three dimensional source image through **a three dimensional wavelet transform wherein resultant subband coefficient data comprises interslice correlation information**, receiving said ordered request list from the client computer and progressively transmitting to said client computer three dimensional subband coefficient data blocks corresponding to said given region of interest in accordance with said ordered request list.

Present Invention is 3D Image Streaming with Generation
of Interslice/Inter-Image Correlation Information

In direct contrast, the image streaming system of the present invention is all about transmitting 3D source images over a communications network as opposed to transmitting 2D images (which was disclosed and claimed in the commonly assigned '452 patent). As taught by the present invention, a 3D image may comprise either a three-dimensional image, a sequence of two-dimensional images, etc. An example of a sequence of two-dimensional images is video sequences such as ultrasound or other medical related imaging.

It is submitted that performing wavelet transforms and image streaming of 3D images is substantially different than performing wavelet transforms and image streaming of 2D images. As mentioned supra, virtually the entire specification including the Figures of the present

application is devoted to teaching the specific case of and special aspects of 3D wavelet transform based image streaming.

With regard to the Figures, several Figures clearly demonstrate the 3D focus of the present invention. Figure 3, for example, illustrates the 3D subband decomposition and tiling of subband coefficients at a given resolution. Figure 4 illustrates three subband decomposition types taught by the invention. Figure 5 illustrates a multi-resolution structure of transformed 3D image data. Figure 6 illustrates multi-resolution decomposition of 3D image data into 3D based coefficients. Figure 7 illustrates scaling factors of 3D wavelet coefficients for different subbands. Figure 8 illustrates tile dimensions (which are 3D tiles) and the addition of half-bit information planes for lossless subband decomposition types.

Further, the forward and inverse wavelet transforms disclosed are 3D transforms intended to be applied to 3D source image data. Specifically, with reference to paragraph [0076] of the publication of the present invention (i.e. US2003/005140A1) the 3D wavelet transform creates eight subbands for each given resolution. These are denoted as lll, llh, lhl, lhh, hll, hlh, hhl, hhh. Only the subband lll is passed to the next resolution level processing.

The present invention discloses three different types of subband decomposition which are shown in Figure 4. These are described in paragraphs [0090] through [0093]. Each involves performing wavelet transforms in the Z direction (i.e. the third dimension) in addition to transforms in the X and Y directions.

The forward and inverse 3D wavelet transforms taught by the present invention are presented in paragraphs [0109] through [0122]. In particular, the forward transforms for the Z-direction are provided in paragraphs [0117] and [0118] while the inverse transforms are provided in paragraph [0121].

In addition, as aspect of the three-dimensional wavelet transform taught by the present invention is that it is operative to find correlations between frames (i.e. of a two-dimensional image sequence) in order to improve compression of the image sequence over the communications network from the server to the client. This is a feature that only applies to 3D source images.

It is further submitted that a key aspect of the mechanisms of the present invention is that the 3D wavelet transforms taught in the present invention generate **interslice or inter-image correlation** information in the resulting 3D subband coefficient data. In other words, the three

dimensional subband coefficient data embodies (encompasses or represents) correlations between the slices of a three dimensional image or between the images of a sequence of images. Note that the three dimensional image as contemplated by the present invention may comprise a sequence of 2D images. Thus, the 3D wavelet transform of the present invention does not treat each image in a sequence of images as an independent entity. Rather, images are correlated against each other in the Z direction to generate inter-image correlation information as represented in the resultant 3D subband coefficient data.

The Chang et al. Reference - 2D Only Wavelet Transform

Chang et al. teaches a dynamic transfer scheme for transferring data including images from a server to a client. Source data is transformed into a hierarchical representation comprising a plurality of levels of transform data, such that a level of the hierarchical representation comprises transfer data sufficient to reconstruct the source data at a resolution corresponding to the level. The server transfers transform data from a level of the hierarchical representation corresponding to the desired resolution.

It is submitted that Chang et al. teaches an image transfer scheme that is operative to transfer **two-dimensional** images only. Chang et al. does not teach or suggest a scheme for transferring three dimensional images or image sequences nor does Chang et al. teach or suggest applying a three-dimensional wavelet transform to image data.

It is further submitted that no where throughout Chang et al. is there a teaching of transferring 3D images, other than in a passing reference in column 7, line 66 where it is stated that

> "through use of multi-spectrum transform data, the wavelet transform may aggregate multi-dimensional data (e.g., two dimensional, three dimensional, etc.) for a source image. For example, multi-dimensional transform data may be used to reconstruct a source image in three dimensions."

Here, Chang et al. simply mentions in passing that the wavelet transform may aggregate 3D data for a source image. This statement, however, is without any support or enablement whatsoever in the specification and drawings. Nowhere in the '297 patent does Chang provide the slightest detail, teaching or even a hint about how to actually implement a 3D wavelet transform. Change

fails to disclose (1) any description and structure of a 3D source image, (2) any 3D wavelet transforms, (3) a mechanism for steaming 3D image data over the network and (4) the processes that when executed on the server and client computers, implement the 3D image streaming mechanism of the present invention.

In particular, Chang only teaches a 2D transform found on column 9, lines 6-23. In all the discussions regarding the transform, dynamic transfer syntax, request/transfer operation between client and server, etc. Chang makes reference only to 2D images and does not anywhere refer to 3D source images or 3D transforms. Thus, Chang et al. lacks any teaching, embodiment or enablement whatsoever regarding the implementation of a 3D image steaming mechanism.

For example, in column 11, line 28, Chang et al. discusses the decomposition processing using the wavelet transform. It details the mapping from pixel coordinates to physical coefficient coordinates. It states that the coordinates define a rectangle of coefficients, such that the first coordinate $[x_1, y_1]$ represents the upper left corner of the rectangle and the second coordinate $[x_2, y_2]$ represents the lower right hand corner, the first and second coordinates implying a 2D image.

Further, Chang et al. states that the client application is tailored to medical applications, wherein the client application permits a viewer such as a doctor or other medical professional to view large source images such as X-rays, which are 2D images.

Further still, all the imaging examples provided in the Figures include only two dimensional images. Not one Figure in Chang even hints at a three dimensional source image or wavelet transform.

Moreover, it is submitted that Chang does **not** teach a 3D wavelet transform as the 2D wavelet transform taught by Chang does **not generate any correlation information** between slices of a 3D image or between images of a sequence of images. In contrast, this is a key feature of the true 3D wavelet transform of the present invention.

The 2D wavelet transform of Chang is not capable of generating any interslice or inter-image correlation information as the transform is a strictly 2D wavelet transform. Thus, if the 2D wavelet transform of Chang were to be applied to a 3D image or a sequence of 2D images, the result would simply be a sequence of independent 2D transforms with **no interslice or inter-image correlation information** generated whatsoever.

In contrast, the 3D wavelet transform of the present invention **does** generate correlation information between slices of a 3D image or between the 2D images of a sequence of images, as embodied in the resulting 3D subband coefficient data.

<u>Pyramidal Data Structure and 3D Wavelet Transform</u>

In the Office Action of November 29, 2006, the Examiner asserts that Chang et al. teaches three dimensional wavelet transform. More specifically, the pyramidal data structure 130 (Figure 1) in Chang et al. refers the to the three dimensional wavelet transform because the level representation from the base to the top of the pyramid serves as a third dimension.

This assertion is flatly false and incorrect for the following reasons. As is well-known in wavelet transform theory, the pyramidal structure mentioned in Chang refers to the name given due to its appearance of the multi-resolution decomposition result of the application of a wavelet transform to an input signal. This is related to the special properties of the wavelet transform which provides both time and frequency information about a signal. This is in contrast to the well-known Fourier transform which only provides static frequency related information about the signal.

The discrete wavelet transform (DWT) of a signal is calculated by passing it through a series of filters. The input samples are first passed through a low pass filter and a high pass filter. The output of the low pass filter is then passed through low and high pass filters. At each pass, the output of the high pass filer provides the coefficients which correspond to a particular frequency and time resolution. Each successive pass through the filters yields a set of coefficients at a different resolution which correspond to a particular frequency range. The first pass generates coefficients corresponding to the larger frequency range. Each successive pass yields coefficients related to a smaller frequency range. When stacked, they take on the appearance of a pyramid; hence the term "pyramidal data structure" used to described the decomposition process. The pyramidal data structure, however, has absolutely no connection to the image signal. The pyramidal data structure referred to by Chang has no connection whatsoever with the 3D aspect of the image source of the present invention.

<u>Conclusion: Present Invention is not Anticipated by Chang et al.</u>

Thus, the 3D wavelet transform and related aspects of the streaming process are integral features of the invention. Each of the independent claims includes limitations directed to the three dimensional aspect of the invention.

Thus, as explained above in detail, Chang et al., fails to teach or suggest whatsoever image streaming of three dimensional images and the generation of interslice or inter-image correlation information or any type of three dimensional wavelet transform and thus does not anticipate the present invention. The Applicant respectfully traverses the rejections of claims 6, 10, 16, 20, 26, 30-33, 35-37, 39-54 and submits that the presently claimed invention is patently distinct over Chang et al.

It is believed that claims 6, 10, 16, 20, 26, 30-33, 35-37, 39-54 overcome the Examiner's § 102(e) rejection based on the Chang et al. reference. The Examiner is respectfully requested to withdraw the rejection based on § 102(e).
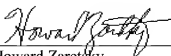
Conclusion

In view of the above amendments and remarks, it is respectfully submitted that independent claims 6, 16, 26 and 43 and hence dependent claims 10, 20, 30-42, 44-54 are now in condition for allowance. Prompt notice of allowance is respectfully solicited.

In light of the Amendments and the arguments set forth above, Applicant earnestly believes that they are entitled to a letters patent, and respectively solicit the Examiner to expedite prosecution of this patent applications to issuance. Should the Examiner have any questions, the Examiner is encouraged to telephone the undersigned.

Customer Number: 25937

Respectfully submitted,

ZARETSKY & ASSOCIATES PC

Dated: September 26, 2007

By: _Howard Zaretsky_

Howard Zaretsky
Reg. No. 38,669
Attorney for Applicants

Zaretsky & Associates PC
8753 West Runion Dr
Peoria   AZ 85382-6412
Tel.: 623-362-2585